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[54] **GYRICON DISPLAY WITH INTERSTITIALLY PACKED PARTICLES**

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[XX .
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[51] **Int. Cl.**[6] **G02B 26/00**

[52] **U.S. Cl.** **359/296**; 345/107

[58] **Field of Search** 428/323, 331, 428/327, 402, 407, 375, 688; 156/63; 359/296, 298; 345/107, 108; 349/117, 188; 427/212, 214; 364/4, 8, 15, 7

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[57] **ABSTRACT**

A gyricon or twisting-ball display having superior reflectance characteristics comparing favorably with those of white paper is based on a material made up of two populations (e.g., two different sizes) of optically anisotropic particles, such as bichromal balls, disposed in a substrate. Particles of the first population, as considered by themselves without the particles of the second population, are disposed in the substrate in a closely packed (e.g., geometrically regular) arrangement having interstices. Particles of the second population are disposed in the interstices of the arrangement. A rotatable disposition of each particle is achievable while the particle is thus disposed in the substrate; for example, the particles can already be rotatable in the substrate, or can be rendered rotatable in the substrate by a nondestructive operation performed on the substrate. In particular, the particles can be situated in an elastomer substrate that is expanded by application of a fluid thereto so as to render the particles rotatable therein. A particle, when in its rotatable disposition, is not attached to the substrate. A reflective-mode display apparatus can be constructed from a piece of the material together with a mechanism (e.g., addressing electrodes) for facilitating rotation of at least one of the particles.

27 Claims, 18 Drawing Sheets